

150-kW PEM Fuel Cell Power Plant Verification and Regional Demonstration of 150-kW PEM Fuel Cell Power Plant (New FY 2004 Project)

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Objectives

- Verify the specification, durability, and reliability of a 150-kW natural gas fueled proton exchange membrane (PEM) power plant
- Verify multiple power plants can be connected to a distribution feeder with no adverse interconnection effects
- Confirm that integration of power plant heat with a liquid desiccant dehumidification system increases warm weather heat utilization
- Demonstrate market viability and expedite commercial application of large PEM fuel cell power plants in the distributed generator (DG) market
- Validate grid interconnectivity compliance with UL1471 and IEEE1547 at utility sites throughout the U.S.
- Demonstrate high power plant availability in utility generation service

Technical Barriers

This project addresses the following technical barriers from the Fuel Cells section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year RD&D Plan:

Distributed Generation Systems

- E. Durability
- F. Heat Utilization
- G. Power Electronics

Fuel-Flexible Fuel Processors

- J. Durability

Components

- P. Durability
- R. Thermal and Water Management

Approach

UTC Fuel Cells (UTCFC) is in the process of developing a 150-kW PEM power plant whose planned specifications will meet the DOE targets for fuel cells.

As part of this project, the prototype power plant operated in Task 1 is dedicated to verifying the specification and capability to operate in climate extremes. In Task 2, the plan is to field three evaluation power plants that demonstrate power plant reliability. Cell stack and fuel processor catalyst durability testing and accelerated stress testing of mechanical components in Task 2 will complement the power plant data. Field evaluation power plants will provide an experience base in order to demonstrate high reliability. Task 3 addresses concern with heat utilization in commercial buildings. Integration between the power plant and liquid desiccant dehumidification will be evaluated by the United Technologies Research Center. Liquid desiccant dehumidification appears to be a good use of power plant heat to address 30 to 50 percent of the air conditioning load. Task 4 seeks to verify that a power plant certified for interconnection to UL1741 can be installed with minimum cost or delay and provides data measured by a distribution utility (Connecticut Light and Power) on interconnection effects of multiple power plants on a single distribution feeder. The Electric Power Research Institute will conduct analysis to extend these results to the U.S. as a whole.

The team assembled to verify the 150-kW PEM fuel cell power plant includes UTCFC, Hydrogen Source (HYS), United Technologies Research Center (UTRC), Connecticut Light and Power (CL&P) and the Electric Power Research Institute (EPRI).

As part of the regional demonstration portion of this project, UTCFC will use four 150-kW PEM natural gas fueled power plants to demonstrate grid connectivity, high power plant availability, low emissions and high efficiency to utilities, owners/operators and the investment community.

A Team of UTCFC, New York Power Authority, Austin Energy, San Francisco Public Utilities Commission/Hetch Hetchy Water and Light, and EPRI has been formed to provide expertise in the area of grid interconnectivity.

Use of the 150-kW PEM power plant will assess the readiness of the technology for these initial field demonstrations. The team has defined the work of the project to broadly address grid interconnectivity issues. The issues include 1) participation in developing and reviewing interconnectivity standards, e.g., UL1471 and IEEE1547 and individual State standards and regulations for grid interconnection; 2) selecting utility test sites in load intensive areas with a diversity of grid characteristics, e.g., generating mix, load composition, equipment and generator age, and geographical, regional and climatic variation; 3) confirming applicability of standards to all sites and situations and establishing appropriate field test protocols for confirmation; and 4) resolving specific technical issues, e.g., islanding, fault clearing capability, personnel safety considerations, reactive power support, and power quality including flicker, voltage sag and harmonics.

The regional demonstration project technical work is conducted in three tasks. In Task 1, the Team will select a diversity of sites throughout the U.S. for installation and testing of power plants. UTCFC will fabricate, acceptance test and deliver power plants to the sites for installation. The host utility will install the power plant. In Task 2, host utilities will perform tests to determine power plant availability, emissions, efficiency and grid connectivity characteristics. UTCFC will provide field support to demonstrate a power plant availability of more than 95%. UTCFC also will evaluate two alternative strategies for cost effectively achieving availabilities of more than 95% in commercial service. In Task 3, EPRI and UTCFC will establish protocols for grid connectivity testing. EPRI and UTCFC will analyze the grid connectivity data collected by host utilities and the remote data center to validate the use of standards UL1471 and IEEE1547 for grid connectivity certification and grid connection.